

researchnotes

Transportation-Efficient Land Use Mapping Index (TELUMI)

Background

Phases 1 and 2 of this research highlighted the importance of local land-use regulations in implementing transportation-efficient development. Land uses are transportation efficient if they support the use of alternative travel modes (carpooling, vanpooling, walking, bicycling, and transit), while reducing the need to drive alone. The researchers found that areas that had zoning and development regulations in place were able to implement transportation-efficient development, but those that did not were not as successful. As a basic tool for guiding development, regulations work. In addition to regulations, a variety of other actions are used to implement transportation-efficient development. Design review programs were particularly effective, as were other incentives.

The purpose of this project, Phase 3, was to develop an urban form index for the Central Puget Sound Region that could be used to evaluate existing land use patterns and travel behavior and transportation systems in general and develop an index which could be used to support decision-making for prioritizing and programming transportation investments.

The Problem

This third phase of the Integrating Land Use and Transportation Investment Decision-Making project culminated with the Transportation Efficient Land Use Mapping Index (TELUMI). The objective of this last phase was to devise a conceptually simple tool that operationalized the complex relationship between land use and travel behavior.

To be a useful tool, the TELUMI required systematic construction, based on extensive review of past research, as well as new studies and substantial inputs from national and local experts in land use and transportation. This report made explicit the conceptual and technical frameworks employed in the development of this work.

What We Did

TELUMI evaluated the impacts of different land-use variables on transportation system efficiency by using maps and quantitative data. Maps and data are available for the urban growth areas (UGAs) of the Puget Sound region (King, Pierce, Snohomish, and Kitsap counties).

The TELUMI is a set of maps that depicts how the region's urban form relates to overall transportation system efficiency as shown in the example in Figure 1. Nine map layers represent the effects of individual land-use variables on transportation efficiency. They include density (residential and employment), mix of uses (shopping and school traffic, the presence of neighborhood centers (NC)), network connectivity (block

size), parking supply (amount of parking at grade), pedestrian environment (slopes), and affordable housing. The tenth layer is a composite index, which takes into account the relative effects of each of the nine variables on transportation efficiency, based on a statistical analysis that modeled the relationship between the land-use variables and King County bus ridership.

Each land-use variable is mapped using three categories, which define zones of high, latent, and low transportation efficiency (TE) (See Table of TELUMI Measures and Thresholds). High TE values correspond to many, and convenient, transportation options, including transit, non-motorized, and other non-SOV travel options.

Low TE corresponds to few transportation options beyond single occupant vehicle (SOV) travel. Latent TE indicates that travel options remain limited, but that land-use conditions in these zones are favorable enough to permit easy and effective increases in future travel options—either via transportation system investments, demand management or other programmatic actions, or land-use changes. From a policy planning and programming perspective, zones in latent TE present the greatest opportunity for high returns on future investments in land use and transportation systems.

TELUMI Measures and Thresholds

Domain	Measures	Transportation Efficiency (TE) Thresholds		
		Low	Latent	High
Density	Residential Area (DU/net acre)	<6	6-10	>10
	Employment Density (employees/non-residential acre)	<30	30-70	>70
Mix of Uses	Proximity of groups to destinations	Presence of neighborhood cluster (restaurant, retail, grocery) = high		
	Trip generation rates (number of school and shopping trips)	0	1-455	>455
Network Connectivity	Average street-block size (acres)	>10	10-6	<6
Parking Supply and Management	Percent of at-grade parking lots in commercial areas	>75%	35-75%	<35%
Pedestrian Environment	Topography	>5%	2.5-5%	<2.5%
Affordable Housing	Net percent of housing below countywide median	<25%	25-47%	>47%

What We Learned

The composite layer of the TELUMI in King County yields challenging information on the transportation efficiency of present land use conditions. Focusing within King County's UGA, for example, the areas with high and latent TE are small, at 8 and 9 percent, respectively. This is both good and bad news. The fact that existing areas with many transportation options are small means that future investment and/or policy changes can be targeted to small geographic areas and, thus, involve relatively few targeted populations and facilities. But the large areas with low TE (83 percent of King County within the UGA) are likely to be difficult to upgrade without substantial investment.

Second, however, the TELUMI shows that high and latent TE areas contain a high proportion of residential units and employment. More than 40 percent of the residential units, and nearly 80 percent of the employment in King County's UGA, are in high and latent TE areas. This indicates that a good proportion of residential and employment activities are concentrated enough already to support many travel options. Future focus on and investment in latent TE zones (with 23 and 30 percent of the King County residential units and employment, respectively) should substantially increase travel options for a sizeable portion of the population.

Third, 1-km buffers along King County's freeways and primary streets show that only 20 percent of these facilities are in areas of high and latent TE. This suggests that the road network may be out of balance with, or not supportive of, adjacent land use patterns. This finding raises difficult questions, since many of these facilities can be major bus corridors. However, the calculations measure only the presence or absence of transportation facilities, not their capacity. Further study is needed to relate transportation systems' capacity to land-use conditions—for instance, calculating areas at the different TE levels that are related to different levels of bus transit service.

Finally, analyses of five sample areas used in the development of the TELUMI support many of the assumptions made during the course of this project. (The sample areas are Wallingford and Queen Anne in Seattle, Downtown Bellevue, Downtown Kirkland, and the Crossroads area of Bellevue). With only 15 percent of its area having high TE, the suburban neighborhood of Crossroads is associated with the fewest and least convenient non-SOV transportation options of all sample areas. Downtown Kirkland comes next, with 33 percent of its area having high TE; while in downtown Bellevue, Wallingford, and Queen Anne, more than 70 percent of their areas have high TE. Interestingly, in Crossroads and Kirkland, 34 and 38 percent of their areas have latent TE, respectively, a finding that supports the high potential that these two neighborhoods or districts are commonly believed to have for future transportation efficiency.

What the Researcher's Recommend

The TELUMI is a tool to test the potential impacts of changes in one land-use variable (such as employment density or amount of parking at ground) on travel options, thereby providing policy makers with a way to assess the relative power of different investments, programs, or policy/regulatory changes in the use of transportation facilities. While the TELUMI now shows how to rate areas of the Puget Sound for their existing transportation efficiency, it can and should also be used to set goals for future transportation efficiency and to monitor progress over time. Changes in the values of such land-use variables as employment density or amounts of parking at grade can be assessed in terms of their impact on the region's overall transportation efficiency. Such changes can be targeted to the entire region or to specific areas such as Designated Urban Centers or the areas along or near primary transportation facilities.

The visual dimension of the TELUMI's maps make the tool an attractive means of communication with all audiences, while it's quantitative capabilities can speak to transportation and urban planning professionals. Lay audiences can quickly grasp where zones with latent TE are, and how feasible changes in land use might be in these specific areas to improve transportation options. Professionals can then model the effects of the changes on transportation systems.

The TELUMI's applicability to planning/decision making processes concerned with general transportation issues can also be further focused on transit use, distinguishing, for example, between bus transit and light rail options. It can also be extended to other land use-related issues such as environmental planning, watershed analysis, brown field redevelopment, or the management of public utilities.

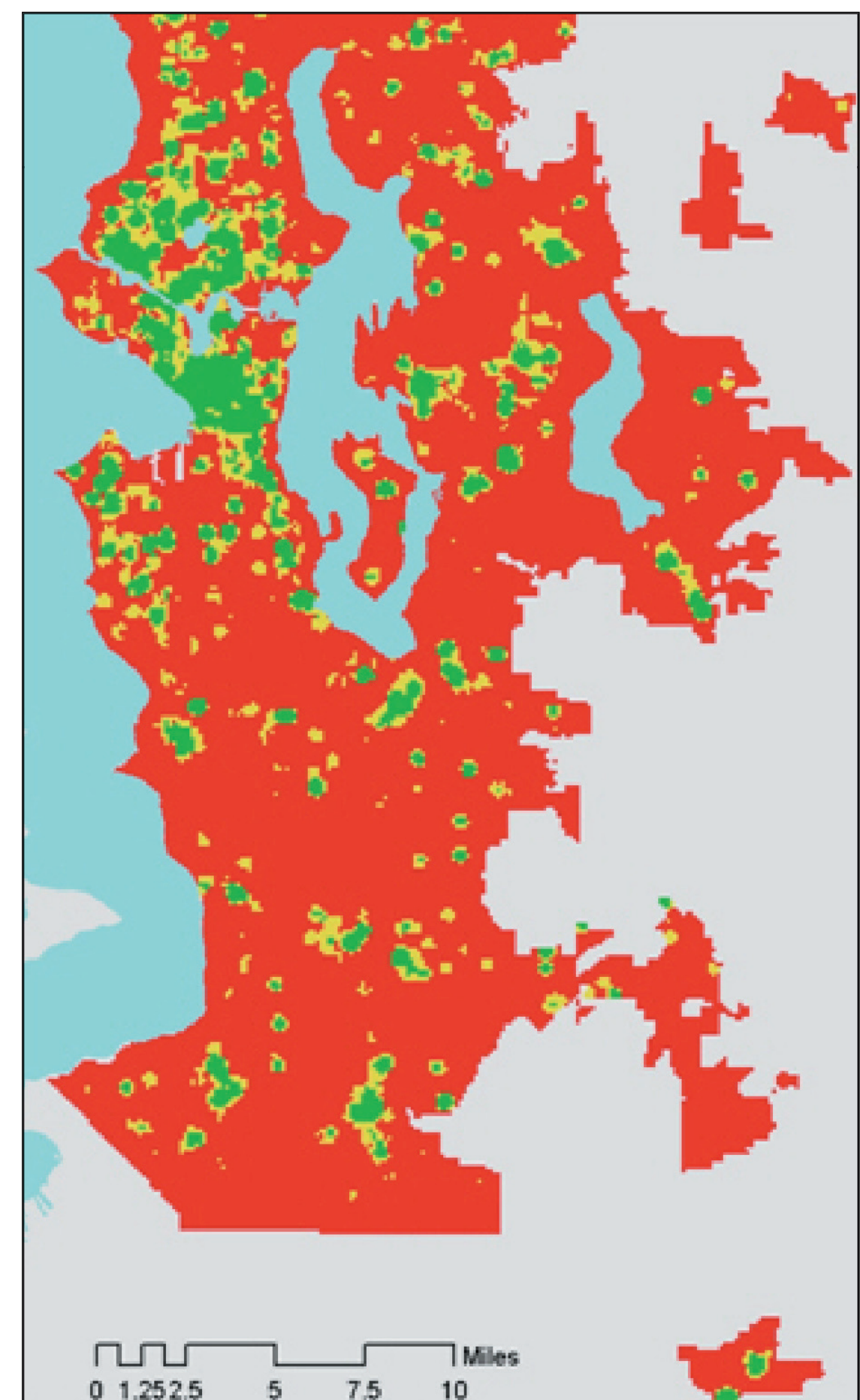


Figure 1. Transportation Efficient Land Use Mapping Index¹.

¹ King County – the Index is also available for the entire Puget Sound region, including Pierce, Snohomish, and Kitsap counties. Green indicates high transportation efficiency; yellow and red show areas in latent and low transportation efficiency, respectively.

Summary of Implementation

WSDOT recognizes that local land use decisions impact the total efficiency of existing and planned investments in the transportation system. Until this research, a methodology or tool did not exist that could give quantitative guidance on what and where investments might be most efficiently made in the region.

The project took a methodology – cartographic modeling – that had been recently developed for environmental analysis and applied it to the land use and transportation relationship. Although the concept is simple and the results are easy to communicate and use, data development and calculations need time and testing to ensure they reflect the land use and transportation relationship accurately.

Transportation planners in the Puget Sound Region can use TELUMI during the development of corridor studies and Environmental Impact Statements. WSDOT's Environmental Affairs Office has shown interest in adopting the TELUMI methodology for environmental analysis.

This project has value for department planners in the Puget Sound Region, as WSDOT looks to prioritize and program various investments. TELUMI's set of maps depicts how the region's urban form affects overall transportation system efficiency. TELUMI can be used to assess the impact of land use on travel behavior and transportation systems in general, which can be used to support decision-making for prioritizing and programming transportation investments.

Presentations have been made to the Puget Sound Regional Council's staff, as they are interested in using the TELUMI in the development of Vision 2020 Plan. The tool was presented at the annual conference of the American Planning Association of Washington State, and will also be presented at the Transportation Research Board annual conference of 2006. The tool was published in the TRB Record Journal, Issue Number 1902, in October of 2005.

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